COMMERCIAL POND FISH CULTURE USING WASTE WATER

by

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ABSTRACT

Waste water from some National Electric Power Authority (NEPA) housing units was fed to a 0.4 ha pond which was stocked with 2,200 Sarotherodon galilaeus fingerlings with a mean weight of about 36.0gm and 1000 Cyprinus carpio fingerlings with a mean weight of 10gm. This yielded after 10 months over 2300 kg of harvestable fish plus over 20,000 Sarotherodon galilaeus fingerlings. The growth rate of Cyprinus carpio was not very encouraging possibly because of the type of plankton that colonised the pond. The Sarotherodon galilaeus became stunted because of over population as there were no carnivores to control their excessive breeding. The physico-chemical parameters were favourable for the growth of fish food organisms.

INTRODUCTION

Organic wastes are extensively used in many regions of the world to replace part of, or all supplementary feeding in fish ponds. Cow manure and sewage from small towns have been demonstrated to be commercially useful bases for natural fish foods. This has resulted in large increases in fish yield per unit area of pond as well as sharp decrease in feed conversion coefficient. Schroeder (1973, 1974) showed through his study of 35 commercial fish ponds with fish stocking densities ranging from 1 to 5 tons/ha that the amount of natural food in the ponds was the most important parameter in determining the efficiency at which supplementary feed was utilized by the fish for growth. This led to the discovery of fluid cow manure which contains urine and faeces as a successful but inexpensive nutrient for increasing the productivity of natural fish food organisms in ponds.

Human sewage has also been shown as other types of organic manures to have significantly increased fish growth in ponds but aesthetic considerations often limit its use. However, holding the fish in clean water ponds for several weeks at the end of the growing season has proved to be a pragmatic

method for providing fish acceptable for market (Schroeder and Hepher, 1976). This flush-out period has been shown to remove residual objectionable odours and pathogens. Human wastes from a town of 5000 people has been used as a fertilizer and feed directly into a 4 hectare reservoir fish pond and this yielded 2,800 kg/ha/6 months. Similarly human wastes from a population of 500 people fed into fish ponds of 3 ha in area with supplementary feeds at daily rates of 3 - 4% of the biomass but without chemical fertilization, yielded 8600 kg/ha/8 months with a feed conversion coefficient of 1:1. But adjacent non-sewage ponds receiving chemical fertilization and similar supplementary feeds yielded 4700 kg/ha/8 months with feed conversion coefficient of 1:2. Fish growth therefore as stated by Huet (1982) depends greatly on the quality of the water used in the pond and the quality of water depends upon where it comes from and what kind of soil it travels over. Lake Laguna, Philippines a very productive lake with a surface area of 900 km^2 and average depth of 3 meters, has about 5000 ha of fish pens, where milk fish is commercially cultured. This lake is fed by domestic and industrial effluents from the capital city, Manila with a population of over 6 million people. In Kano State, Jakara Dam Reservoir into which flows River Jakara which passes through Kano metropolis collecting all the refuse wastes, sewage and industrial waste has been declared a chemically polluted reservoir. This reservoir has been shown to be dominated by Tilapia species which form 97.04% by weight of the total catch while Clarias species formed only 2.96%. These Tilapia species are stunted as a result of over population as majority of them are caught by 63.5mm gill net. Similarly, the I.I.T.A. Ibadan 70 ha reservoir which is also a circulatory waste water is dominated by Tilapia species but with the recent introduction of Lates niloticus to control the population of Tilapia it is very common to catch Tilapia species weighing average weight of 500 gm and above.

In the light of the above facts, a polyculture trial of Sarotherodon galilaeus and Cyprinus carpio was undertaken in one of the waste waters in New Bussa to determine:-

(i) The physico - chemical parameters of such a eutrophic water body.

(ii) The growth and survival of these two fish species in the waste water.

(iii) The yield and fingerling production of the fish species after one year culture period.

Materials and Methods

The study was carried out at the NEPA sewage pond situated at the back of the State Ministry of Agriculture and Natural Resources, New Bussa. The sewage pond with a surface area of 0.4 hectare, average depth of 1.0 meter and a 30 cm diameter inlet pipe and 15 cm outlet pipe to let out excess

water during heavy down-pour, was built in 1965 primarily for the collection of waste waters from some parts of the NEPA quarters with a population of about 2,000 people.

The sewage pond was stocked on 1st July, 1985 with 2,200 tilapias mostly Sarotherodon galilaeus fingerlings with a mean weight of 36.0gm and 1,000 fingerlings of Cyprinus carpio with a mean weight of 10gms. The gut content of C. carpio was analysed using point and gravimetric methods. Monthly sampling was undertaken to monitor the growth rate of the stocked fish. Biweekly samplings for physico-chemical parameters such as temperature (air and water) hydrogen ion concentration (pH) dissolved oxygen concentration, nitrates and phosphates were taken at the inlet, outlet and main body of the pond according to the techniques described by Golterman (1980), A.P.H.A. (1980) and Hach (1980).

Results and Discussion

Fish harvest at the waste water started in May, 1986. So far about 1580 kg of marketable size S. galilaeus with a mean weight of 51.3 gm have been harvested along with 173.8 kg of fingerlings which have been processed into fish meal. This harvest also includes 825 kg of Cyprinus carpio fingerlings with a mean weight of 50.3 gm and which was divided roughly into four size groups of 9.5 - 12.5, 12.6 - 15.5, 15.6 - 18.5 and 18.6 to 21.5 cm. In addition an estimated 20,000 S. galilaeus fingerlings were produced during the ten month period.

The Cyprinus carpio fingerlings in the waste water were noted to have shown a slow growth rate due to the nature of the food available to them. The phytoplankton of this waste water is over 80% Scenedesmus and this has been shown not to be easily digested by C. carpio. This must have invariably accounted for the slow growth rate of the C. carpio fingerlings. The occurrence of the various food items in the stomach of different size groups as shown in Table 1 could be summarized under eight basic food items with detritus constituting 20.21%, insect larvae 18.16%. phytoplankton 12.21%, zooplankton 9.85%, aquatic vegetation 9.23%, seed shell 7.38%, ants 5.54% and unidentified algae 2.77%. Insect larvae formed the dominant food item and this is in line with the work of Swingle (1957), Huet (1972) and Crivelli (1981) who seem to agree that the principal constituent food of Cyprinus carpio fingerlings is insect larvae. It is oberved from Table 1 that the rate at which each size group feeds on planktonic organisms increases as the size of the fish increases. This agrees with Huet (1982) who documented that older carps feed predominantly on 75% planktonic organisms.

The mean values of the physico-chemical parameters analysed for the four sampling stations from October, 1985 to April, 1986 are shown in Table 2. From this, it is observed that increase in water temperature coincides with decrease in the

dissolved oxygen content. This agrees with the observations of Huet (1972). The pH value was high in all the sampling stations. There was high photosynthetic activity in the water body (15.70 mg. O_2/lit/day) thus leading to high pH value. This agrees with the observation of Boyd (1979) that the photosynthesis of aquatic plants removes carbon dioxide from water during the day and causes a rise in pH. Schroeder (1975) also observed that sewage treatment ponds stocked with fish have higher average dissolved oxgen concentrations and pH than similar ponds without fish. The production of nitrogen in eutrophic water is high especially when there is plankton bloom and concentrations of organic nitrogen might exceed 2 or 3 mg/l (Boyd, 1979). The result obtained for available nitrate ranged from 3.6 to 4.1 mg/l. This agrees with Boyd (1979) who observed that human wastes and domestic detergent wastes lead to high values of phosphate content and low values of nitrogen content especially where the results in Table 2 indicate that highest phosphate value corresponds with lowest nitrate value.

CONCLUSION

The physico-chemical parameters of the NEPA waste water in New Bussa were found to be favourable for the growth of fish food organisms for increased fish production. Stocking such eutrophic water with only non-carnivorous and planktonic fish species especially Tilapia species, could lead to stunting as the Tilapia could breed prolificly. However, the waste water could be used specifically for the supply of Tilapia fingerlings for stocking other ponds and water bodies. Otherwise, few voracious feeders could be added to effectively control the prolific nature of Tilapia. The effectiveness of sewage pond has been shown to be actually improved by stocking it with fish.

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Table 1. Percentage Occerrence of Food items in Stomachs of *Cyprinus carpio*

	9.5 - 12.5	12.6 - 15.5	15.6 - 18.5	18.6 - 21.5	Mean % of Food Eaten
Insect larvae	26,07	14.21	24.70	22.22	21.80
Diatoms	8.70	4.74	5.88	3.70	5.76
Cyclops	8.70	3.68	2.35	3.70	4.61
Brachionus	-	1.58	-	-	0.40
Clostorium	8.70	7.37	7.06	14.82	9.49
Scenedesmus	8.70	4.21	4.71	-	4.41
Unidentified algae	-	2.11	4.71	3.70	2.63
Aquatic vegetation	-	10.53	7.06	14.82	8.10
Ants	4.35	5.79	5.88	3.70	4.93
Detritus and Mud	13.04	23.68	17.65	11.11	16.37
Seed shell	-	8.42	4.71	14.32	6.99
Unidentified food items	8.70	8.42	11.76	7.41	9.07
Incidental food items (sand and scales of fish)	13.04	5.26	3.53	-	5.46

The percentage of each kind of food for each size group of fish in vertical columns add to 100

Table 2. Mean values of the physico-chemical parameters analysed for the four sampling stations during the study period

Parameters	Sampling Stations Inlet	Mid-Pond 2	Mid-Pond 1	Outlet
Water Temperature (°C)	29.4	25.8	26.9	26.9
Dissolved Oxgen (mg/l)	4.6	7.3	7.2	7.1
Hydrogen Ion Concentration (pH)	7.9	8.4	8.4	8.4
Nitrates (No_3 - N)	3.60	4.10	4.0	3.68
Phosphates (PO_4-P)	1.00	0.80	0.95	0.72